in the ureter for seven days. By properly illuminating the interior of the bladder, the openings of the ureters are easily seen and the introduction of instruments not difficult. The author uses for this purpose thin, elastic bougies, as he considers the use of Simon's metal catheters too dangerous.

The treatment of malignant tumors of the urinary bladder has consisted for the main part, until the present, in scraping away portions of them and cauterizing the surface in order to retard, if possible, their rapid growth.

Radical treatment has been only undertaken in cases where the carcinoma was favorably situated, for example, on the anterior wall of the bladder. Successful operations for carcinoma in other parts of the bladder should not be considered impossible, if the limits of the mucous membrane have not been passed, for which, of course, an early diagnosis of the disease will be necessary.

In conclusion, Küster thinks that the therapy of tumors of the bladder, far from being so hopeless as formerly thought, has improved so much that the larger number of those suffering from this terrible malady may be almost definitely cured by a timely and proper operation.

C. J. COLLES.

ON THE PRESENT STATE OF KNOWLEDGE IN BACTERIAL SCIENCE IN ITS SURGICAL RELATIONS.

(Concluded from page 150).

ACTINOMYCOSIS—ANTHRAX—GLANDERS.

The study of those branches of bacteriology which have direct bearing upon veterinary surgery and public economy has borne more practical fruit than any other department of the science, leading, as it has done, to an early and comparatively complete knowledge of certain zoonotics, as instanced, at least in Europe, by the successful enforcement of public and private measures by legislative bodies and cattle-farmers for the purpose of preventing the occurrence and spread of such diseases. And out of these investigations, of such practical value to veterinary surgery, a material advance in our theoretical knowledge of those surgical infectious diseases in man has sprung, which owe their origin to contagions contracted from and generally restricted to the lower animals.

Although our knowledge of these diseases appears merely in the light of a side-issue of veterinary bacteriology (a subject which we cannot here enter upon), and has received but relatively little advancement by the most recent investigations, the diseases themselves still offer sufficient interest—an interest even enhanced by the comparative rarity of their occurrence—to deserve a brief consideration in these pages.

Of the diseases referred to, *actinomycosis* is still the most obscure. The general impression is that it is very rare; but it is unquestionably often not recognized, when present, and it is probable that it would be more frequently diagnosed, if the disease were better known.

Pathologically considered the disease in its early stages, manifests itself by the appearance of a soft whitish tumor frequently situated on the lower jaw or in front of the spinal column, and connected with the bone. A section through the tumor shows a great number of softer foci of the color of sulphur, which stand well out against the more reddish ground.

In the course of time the tumor breaks down and an abscess is formed. The pus vented by incision or spontaneous ulceration contains numbers of sulphur-yellow miliary bodies of soft consistence and fatty feel, which aré frequently united together in clusters resembling mulberries. By pressure these clusters are easily separated into their elements, which prove, when viewed under the microscope, to consist of inter-twined fungus-mycelia, the single threads of which appear radially arranged around their centers, each one increasing in diameter towards the periphery, where they present bulbous termini. Inoculation experiments prove these fungus masses to be the cause of the disease; hence the name. A proper classification of the parasite, however, has not yet been accomplished, the probabilities being that it belongs to the class of fungi proper.

Actinomyces in man were first described by Lebert,[1] but were not recognized as parasites until Bollinger published his celebrated pathological treatise on the subject twenty years later. The etiology of the disease is still quite obscure, although the frequency of the disease in oxen has often suggested the possibility of infection by the consumption of raw beef—a supposition which would account for the greater comparative rarity of the disease in England and this country.

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[1] Traité d'anatomie pathologique I. p. 54, 1857. Referred to by Firkert, l. c.

The localization of the disease in man may be various. James Israel in his monograph of the disease, in which he gives an account of 38 cases,[1] divides all cases into four classes; (1) those in which the parasite gains entrance through a carious tooth or a wound in the oral cavity, and leads to an affection of the jaw; (2) those that present affections of the respiratory tract—which frequently spread to the pleuræ and spinal column; (3) those in which the intestinal canal is primarily affected; and (4) those of doubtful origin. Cases of actinomycosis of the Fallopian tubes spreading to the peritoneum have likewise been reported[1] suggesting an entrance through the genital tract..

In 1884 O. Israel claimed to have cultivated actinomyces in pure cultures on ox-blood serum,[2] and stated that their growth was slow. This latter statement would very well correspond with the clinical aspects of the disease, which shows the active suppurative processes to be much more sluggish even than in tuberculous disease.[3] But the description of the cultures so lacks completeness and lucidity, that his statements have not been generally accepted by bacteriologists. Other culture experiments were commenced by Jahne,[4] but were never entirely completed. To the knowledge of the present writer no satisfactory cultures of the fungus have been published up to the present time.

Inoculations with the actinomyces-germs have been successfully performed by Ponfick,[5] Jahne,[6] and J. Israel.[7]

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[1] *Zemann.* Ueber die Actinomycose des Bauchfells u. der Baucheingeweide beim Menschen, Wien. Med. Jahrb. 1883, p. 477.

[2] Ueber die Cultivirbarkeit des Actinomyces. Virch. Arch Vol. 95. 1884.

[3] *Firkert.* L'Actinomycose de l'homme et des animaux. Paris. Félix Alcan. 1884.

[4] Deutsch. Zeitschr. f. Thiermed. 1881. Vol. 7, p. 155.

[5] Die Actinomycose. Berlin. Hirschwald. 1881.

[6] Centralbl. f. d. med. Wiss. 1880. No. 48

[7] Berlin Med. Society. 13 June. 1883.

Staining of the actinomyces can be effected by any aniline dye, in the same manner as that of ordinary fungi. The staining will, however, again wash out in water. Pilocarmin stains them yellow. In sections they may be stained a different color from the surrounding tissues with the help of aniline dyes, or the sections may be colored in Orseille for one hour, washed off in alcohol and then stained with gentian violet (Weigert).[1]

Recent cases of the disease have been published by Zemann[2] (5 cases), Chiari,[3] Middeldorpff[4] (2 cases), Muller[5] and Magnussen[6] (4 cases), and, in England, by Treves[7] and Schattock.[8]

The prognosis of the disease is generally unfavorable, if the infection has in any way spread. Timely surgical interference may effect a cure. Not less than thirteen cases of recovery have been reported. The treatment consists in incision of the abscess and scraping-out of the cavity. The affection is frequently taken for scrofulous disease.

Anthrax, or malignant pustule, as the disease is clinically called in its surgical aspect—charbon, splenic fever, wool-sorter's disease and intestinal mycosis being other synonymes—has always been of great interest to bacteriologists for the reason that it was the first mycotic disease discovered in man, and one, owing to the extreme facility of cultivating the virus, which was especially adapted for inoculation and disinfection experiments.

The bacilli of anthrax, when in contact with a suitable soil, such as potato-slices, gelatine, roots of plants, alkaline urine, or various neutral infusions, and at a temperature of 36° C., soon grow to long filaments in which, after a short time, small oval transparent bodies appear at regular intervals, which refract the light in a greater degree than the surrounding parts and survive long after the original filaments have become destroyed. These oval bodies are the spores and again develop under suitable circumstances into bacilli. When treated with chemicals they prove very resistant; so much so, in fact, that it is very generally assumed that any line of treatment which suffices to destroy the vitality of anthrax spores, is more than sufficient to kill all other germs which threaten interference in the treatment of wounds.

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[1] Virchow's Archives. 1881. Vol. 84, p. 245.

[2] L. c.

[3] Ueber primäre Darm-actinomycose des Menschen. Prag. Med. Woch. Schr. 1884. No. 10.

[4] Ein Beitrag zur Kenntniss der Actinomycose Deutsch. Med. Woch. schr. 1884. Nos. 15 and 16.

[5] *P. Bruns.* Mittheilungen a is der chir. Klinik. zu Tübingen. Tubingen 1884. H. Laupp. (3 Heft).

[6] Beiträge zur Diagnostik u. Casuistik der Actinomycose. Dissertation. Kiel. 1885.

[7] Lancet. Vol. I. 1884, p. 107.

[8] Lancet. Vol. I. 1885, p. 808.

The manner of testing the efficacy of antiseptic solutions with anthrax spores is very simple. Silk threads are impregnated with anthrax-bacilli in cultures, and, when the spores are formed are dried. The chemical substance to be tested is mixed with the culture soil in any given proportion, and a prepared thread is laid upon it. In this manner it was shown by Koch that corrosive sublimate-solution, of the strength of 1 in 20,000 sufficed to kill the anthrax-spores; a solution containing one part in 300,000 parts of soil served to exert an inhibitory influence upon their development; that is to say the spores could not develop as long as they remain in contact with this soil; but they were not killed, for on being properly washed off with sterilized water and transferred to other soils not disinfected, they readily developed. These questions have been made the subject of experiment, and papers by Frank[1] and Perroncito,[2] the former studying the effect of antiseptics upon anthrax after Koch, from whose results in regard to figures he frequently deviates—and the latter extending his researches to the effect of heat and disinfection upon the germs.

Introduced into the blood of man or animals the bacilli do not form spores by means of long filaments, but multiply by division in such a manner that the bloodvessels, in the course of a few hours, become crowded with bacilli and death ensues.

The discovery of the nature of the disease is connected with the names of Pollender,[3] Branell[4] and Davaine.[5]

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[1] Ueber die Wirkung einiger Antiseptica auf das Milzbrand contagium. Inaug. Dissertat. Dorpat. 1883.

[2] Ueber die Tenacität des Milzbrand virus in seinen beiden Gestalten als Spore und Bacillus Anthracis. Revue für Thierheilk. 1883, No. 11.

[3] Vierteljahr. f. ger. Med. Vol. 8. 1885.

[4] Virchow's Arch. Vol. 14. 1858.

[5] Compt. rend. Vol. 57. 1863; vol. 77. 1873.

More recent descriptions have been furnished by Koch, who thoroughly investigated the disease in various series of experimental researches,[1] and extended his experiments to the question of attenuation of the cultures.

Following out Pasteur's discovery that certain cultures of a germ producing cholera in chickens, might be so treated that the virus becomes attenuated, and not only fails to produce the disease when inoculated, but acts in a manner preventive of subsequent infections, analogous to vaccination for the prevention of small-pox, Toussaint[2] was able in like manner to attenuate cultures of anthrax by subjecting them to heat of 55° C. for a space of ten minutes. And Pasteur himself subsequently found that if the anthrax-bacilli were cultivated throughout at a temperature ranging from 42° to 43° C. the organisms became attenuated and could be employed for preventive vaccination.[3]

Koch, in his answer[4] to Pasteur, afterwards proved that these statements needed to be somewhat restricted, and showed that immunity from the disease could be obtained in this manner only in sheep and oxen, and that other animals as well as man could not be benefited by such vaccination methods. The material used for vaccination ("*second vaccine*") was, moreover, by no means harmless and caused the death of 10 to 15 per cent. of the healthy animals; nor did such vaccination ensure immunity from spontaneous infection—the usual means of acquiring splenic fever through spores taken into the intestinal tract with the fodder—but only against artificial inoculation.

These objections which banished the hope of the use of vaccination methods in the surgical treatment of human anthrax, Pasteur could not refute, his answer being restricted to vindicating his personal scientific position and achievements, which Koch had never intended to impeach; although he had criticised his methods of inoculating with secretions from the mouth and nose, which abound in micro-organisms, instead of using pure cultures.

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[1] *Cohn's* Beiträge zur Biologie der Pfl., p. 277. Mittheil. a. d. Kais. Ges-Amt. Vol. I, p. 49.

[2] Recherches experim. sur la maladie charbonneuse. Paris. 1879.

[3] Bull. de l'Acad. 1880. 28. Compt. rend. Vol. 92. 1881, etc.

[4] Ueber die Milzbrand impfung; eine entgegnung auf den von Pasteur in Genf gehaltenen Vortrag. Cassel und Berlin. 1882.

The correctness of Pasteur's principle in protecting sheep from charbon by vaccination was fully conceded by German bacteriologists.[1] The duration of acquired immunity of the disease by inoculation is given by Fetz at seventeen to eighteen months for rabbits.[2] An experiment of Buchner's,[3] who believed he could change anthrax bacilli into another species of innocuous germs, the so-called bacilli of hay-infusion, was refuted by Koch, and it was proved that he had simply produced an attenuated form. Other methods of attenuation were subsequently published by A. Chauveau[4] and Chamberland and Roux,[5] but since these and further publications are only of a veterinary interest, we may, for the present, pass them over.

A further proof of the advancement of our knowledge of anthrax over that of other species of bacteria is to be found in the extensive chemical analytical researches conducted with anthrax—a step, as has been before remarked, well calculated to further develop our understanding of the etiology of parasitic diseases.

Neucki[6] chemically analyzed cultures of anthrax spores, and found that the albumen of which they are constituted differed from that of putrefactive germs, in that it was not soluble in acids, but only in alkalies, while the other was soluble both in water, alkalies and dilute acids. Neither contains sulphur.

Szpilmann found that ozone killed putrefactive bacteria, but did not differ from oxygen in its action upon anthrax-bacilli—a fact which has been adduced to explain the morbific action of the germs.

[1] *Koch, Gaffky and Loeffler.* Experimentelle Studien über die Künstl. Abschewächung der Milzbrandbacillen, etc. Mittheil. a. d. Kais. Ges. Amt. Vol. II, p. 141. 1884.

[2] Acad. des sciences de Paris. Séance du 4 Aôut. 1884.

[3] Ueber die experim. Erzengung des Milzbrand contag. aus den Hupilzen. Munich. 1880. Die Umwandlung der Milzbrand bacillen in unscüdl. Bacterien, n. d. entgegnung *Koch's* an *Pasteur.* Virchow's Arch. 1883. Vol. 91, p. 40.

[4] Compt. rend. de l'ac. des sciences. May, 1880. ibid. Vol. 96. Nos. 9, 10, 11.

[5] Compt. rend. Vol. 96. No. 15.

[6] Ueber das Eiweiss der Milzbrand bacillen. Ber. der deut. Chem. Ges. 1884. II. 16, p. 2605.

Notwithstanding the great amount of good work done on anthrax, the lucidity of the subject is still obscured by the appearance, even at the present time, of statements dissenting from the generally accepted facts and theories of bacteriology.

Thus Osol[1] has lately published a contribution to the subject which cannot be made to agree with our present systems of mycology. Taking the blood of horses and sheep that had died after inoculation with anthrax-bacilli, he sterilized it by boiling for from 3 to 14 hours, filtered it while hot, and repeated this process once or twice, adding a little water each time, and, finally, he poured the liquid into bottles which he closed with cotton plugs and again brought the contents to a boil. This liquid he believed to be perfectly sterilized, as he could not produce anthrax in animals by inoculation of minute quantities ($^1/_2$ to 1 ccm.) of it, nor could he infect suitable culture-soils with it. But on injecting larger quantities of this fluid into the abdomen of 17 mice, 16 rabbits and 3 sheep he succeeded—in 7 mice, 8 rabbits and 2 sheep—in obtaining true anthrax, with bacilli and all the pathological symptoms of the disease, which caused their death. Some further animals, 5 rabbits and 5 mice, also died, in the blood of which no bacilli could be found; but the blood of these contained small bodies, highly refractive to light, resembling spores, which in five cases developed on suitable soils to characteristic anthrax-bacilli, and, in all cases, killed the animals inoculated with them. Three rabbits, five mice and one sheep remained healthy. But, what was more surprising, two rabbits and three sheep were shown to have been rendered capable of resisting inoculation with true anthrax, by such inoculations with the filtered sterilized fluid.

Osol believes to have thus demonstrated the existence of a chemical anthrax poison, an anthrax-ptomaïne.

Even if these statements do not concur with our present knowledge of the subject, are in direct opposition to all experiments that have hitherto been so often repeated by the highest authorities, and must, therefore, from our present point of view, be criticised as in some manner faulty (the experiments give the impression of inoculations with insufficiently sterilized spores), it would be unfair to overlook them, until the experiments have been repeated and tested by other reliable experimenters; for, being performed with an organism so well studied as anthrax, they may contain the first steps of an advance in our knowledge of infectious diseases, ultimately leading to some new scientific acquisition, which we have not dreamt of in our bacterial philosophy.

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[1] Experimentelle Untersuchungen über das Anthraxgift. Inaug. Dissertat. Dorpat. 1885. Vide abstract, Fortschritte der Med. Vol. IV, p. 244.

The treatment of malignant pustule, that form of anthrax (the inoculation of a wound with the germ) which the surgeon is usually called upon to attend, and easily recognized by the circumscribed inflammatory œdema encircling the discolored gangrenous center with its characteristic serous discharge, should be in accordance with the general symptoms. If fever is present, it is a sign that the virus has entered the circulation, and no local treatment will be of any avail. The patient should be at once put to bed and kept at rest until the fever has disappeared; the excitement incident to energetic local application to the wound is best avoided. The present writer had opportunities for observing the best results after this treatment, in several cases where inoculations of animals with the serous discharge of the pustule revealed all the virulence of typical anthrax. If no fever symptoms have appeared, it has been advised by Dr. Karg, of Leipsic, to surround the pustule with hypodermic injections of mercuric bichloride, as much as half a grain of which may be given with impunity.

Glanders. Geheimrath Struck announced[1] the discovery of the specific bacillus of glanders by Dr. Loeffler and Prof. Schuetz on the 20th of December, 1882, in the *Deutsche Medicinische Wochenschrift.* The bacillus, very much resembles that of tuberculosis, but does not possess its special staining reaction; it may be stained with methylene blue in watery solution, while it loses the staining obtained in aniline-water, when treated with water containing a little acetic acid.[2]

Following the special methods of Koch its discoverers first microscopically examined the tubercles found in animals suffering from glanders, and here found the bacilli in question always present. They next cultivated the germ in pure cultures on sterilized sheeps' blood through successive generations, and finally inoculated rabbits, field-mice and guinea-pigs with cultures of the fourth or fifth generation (representing a cultivation period of 1 or $1^1/_2$ months) and thus succeeded in producing both local and general infections. They finally also inoculated two horses with pure cultures, one originally obtained from a horse suffering from glanders, and the other from an inoculated guinea-pig; the first horse died in two week's time.

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[1] Vorlaufige Mittheilung über die Entdeckung des Rotzcontagiums im kais. Ges. Amte.

[2] Hueppe, Methoden der Bact-Forsch. Wiesbaden. 1885, p. 67.

Very few days after this publication, Bouchard, Capiton and Charrin[1] claimed to have found the specific organism of glanders, and in a communication in the Bulletin de l'Académie de Médicine[2] Vulpian and Bouley claimed priority of the discovery for these gentlemen. Their description, however, refers to round or ovoid movable bodies, and not to bacilli, so that it is probable that their cultures were not pure ones, yet they must have contained some elements of the specific germs as their inoculation experiments were successful. The discovery of the *bacilli* is therefore attributed to the German scientists.

More recent culture-experiments have been performed by Kitt[3] on potato-soils and on blood-serum, and have served to corroborate the statements of Loeffler and Schütz, besides demonstrating the property of the bacillus to develop at a temperature of 25° C., a degree of heat normally obtaining in moderated climates, and calling attention to the existence of spores, more resistant to destructive agents than the bacilli.

The disease in man is very rare; recent cases have been described by Bucquoy,[4] Esser and Schütz[5] and Ballance,[6] in which either the bacilli were found or inoculations proved successful.

W. W. VAN ARSDALE.

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[1] Sur la culture, etc. Bull. de l'Acad. de. Med. 1882. No. 51.

[2] No. 41. 30 Octob. 1883. "Sur une note communiquée," etc.

[3] Versuche über die Züchtung des Protzpilzes. Jahresber. d. Münch. Thierarzneisch. 1883-84, p. 56.

[4] Bulletin de l'Acad. 24 Juni, 1884.

[5] Rotzübertragung auf Menschen. A. d. Mittheil. a. d. k. preuss. Veterinar-Sanitats-Ber. 1882-83. Arch. f. wiss. u. priv. Thierheilk. Vol. XI, p. 92.

[6] Lancet, Vol. I. 1885, p. 200.